

Engineering Thermodynamics

▼ Dryness Fraction



Let:

$$m = m_f + m_g$$



Again, let:

$$v = v_f + v_g$$

$$s = s_f + s_g$$

$$h = h_f + h_g$$

$$u = u_f + u_g$$



Compiling the above equns, we get:

$$mv = m_f v_f + m_g v_g$$

$$ms = m_f s_f + m_g s_g$$

$$mh = m_f h_f + m_g h_g$$

$$mu = m_f u_f + m_g u_g$$



Again, expressing (m_f) in terms of (m_g) , we've:

$$mv = (m - m_g)v_f + m_g v_g$$

$$ms = (m - m_g)s_f + m_g s_g$$

$$mh = (m - m_g)h_f + m_g h_g$$

$$mu = (m - m_g)u_f + m_g u_g$$



Now, dividing (m) on both sides of the equn, we've:

$$v = \left(1 - \frac{m_g}{m}\right)v_f + \frac{m_g}{m}v_g$$

$$s = \left(1 - \frac{m_g}{m}\right)s_f + \frac{m_g}{m}s_g$$

$$h = \left(1 - \frac{m_g}{m}\right)h_f + \frac{m_g}{m}h_g$$

$$u = \left(1 - \frac{m_g}{m}\right)u_f + \frac{m_g}{m}u_g$$



Now, substituting (x) in place of $\left(\frac{m_g}{m}\right)$ on the above equn, we've:

$$v = (1 - x)v_f + xv_g$$

$$s = (1 - x)s_f + xs_g$$

$$h = (1 - x)h_f + xh_g$$

$$u = (1 - x)u_f + xu_g$$



Applying distributive property to the above equns., we've:

$$v = v_f - xv_f + xv_g$$

$$s = s_f - xs_f + xs_g$$

$$h = h_f - xh_f + xh_g$$

$$u = u_f - xu_f + xu_g$$



Now, taking the common terms together, we've:

$$v = v_f - x(v_g - v_f)$$

$$s = s_f - x(s_g - s_f)$$

$$h = h_f - x(h_g - h_f)$$

$$u = u_f - x(u_g - u_f)$$



And finally, we've:

$$v = v_f - xv_{fg}$$

$$s = s_f - xs_{fg}$$

$$h = h_f - xh_{fg}$$

$$u = u_f - xu_{fg}$$